



The resources you may use include **one magnifying glass**, the **Science Olympiad Official Fossil List** and one **2" or smaller three-ring binder**, as measured by the interior diameter of the rings, containing information in any form and from any source. You are free to communicate with your partner via the chat function on Scilympiad. **DO NOT** consult any other resource!!

IMPORTANT NOTE: If you **cannot see the images**, please skip the question or any other questions related to that image, and let us know in the textbox where you're supposed to write your answer that you were unable to see your answer!!!

IMPORTANT NOTE 2: When asked to identify a specimen, **please identify only to the taxonomic level specified**, and include just the taxon name, e.g. "Mucrospirifer", not "Genus Mucrospirifer"—otherwise **the autograder will mark your answer as wrong**. Also please be mindful of spelling; we will go back and check through all your answers to the best of our ability, but there is a chance that we will miss it and you might not get the credit you deserve.

Good luck and have fun! \(^o^)/

1. (1.00 pts) Identify the genus represented by Specimen A.



Cryptolithus

2. (1.00 pts) Identify the genus represented by Specimen B.



Calymene

3. (1.00 pts) Identify the genus represented by Specimen C.



Elrathia

4. (1.00 pts) Identify the genus represented by Specimen D.



Eldredgeops

5. (2.00 pts) Check the taxonomic groups that **ALL** these specimens fall under.

(Mark **ALL** correct answers)

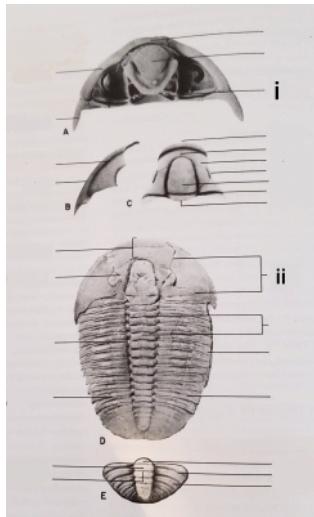
- A) Phylum Arthropoda
- B) Subphylum Crustacea
- C) Subphylum Chelicerata
- D) Class Trilobita
- E) Class Insecta
- F) None of the above

6. (1.00 pts) What type of eyes does Specimen D have?

- A) Holochroal

- B) Schizochroal
- C) Abathochroal
- D) None of the above

Refer to the image below to answer Q7-Q11.



7. (1.00 pts) Which letter illustrates the dorsal view of the cephalon?

- A) A
- B) B
- C) C
- D) D
- E) E

8. (1.00 pts)

The cephalic spines are most commonly located near the posterolateral corners of the cephalon. This is the same location as where another set of "spines" are located. What is the name of this spine?

genal spine

9. (1.00 pts) One of the specimens displayed in this station possesses very exaggerated versions of the feature from the answer of Q8. Which specimen is it?

- A) Specimen A
- B) Specimen B
- C) Specimen C
- D) Specimen D
- E) None of the above

10. (1.00 pts) What is the name of the internal ridge of the exoskeleton that is labeled i?

apodeme

11. (2.00 pts) What are **two** uses for the anatomical structure from Q10?

Expected Answer: supports internal organs (1) AND attachment point for muscles (1)

12. (2.00 pts)

Of the specimens in the beginning of the station, which of the following were able to survive in low oxygen environments (lower than what most living creatures could survive)?

(Mark **ALL** correct answers)

- A) Specimen A
- B) Specimen B
- C) Specimen C
- D) Specimen D
- E) None of the above

13. (1.00 pts) Identify the order represented by Specimen E.



Testudines

14. (2.00 pts) Name the two **shell components** of the specimen you identified in the previous question.

Expected Answer: carapace (1) AND plastron (1)

15. (1.00 pts) Specimen E is best described as

- A) anapsid
- B) diapsid
- C) synapsid

- D) euryapsid

16. (1.00 pts) Identify the genus represented by Specimen F.



Basilosaurus

17. (1.00 pts) Specimen F is best described as

- A) anapsid
 B) diapsid
 C) synapsid
 D) euryapsid

18. (1.00 pts) The terms anapsid, diapsid, synapsid, and euryapsid are in reference to which morphological feature or characteristic of these specimens?

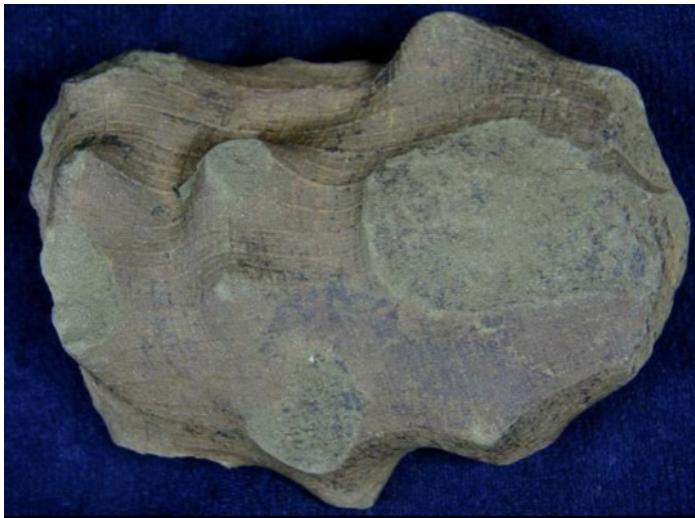
Expected Answer: temporal fenestrae (accept any answer mentioning holes in the skull)

19. (2.00 pts) During which geologic periods would dinosaurs have been able to eat mammals?

(Mark ALL correct answers)

- A) Permian
 B) Triassic
 C) Jurassic
 D) Cretaceous
 E) Paleogene
 F) Neogene

20. (1.00 pts) Identify the genus represented by Specimen G.

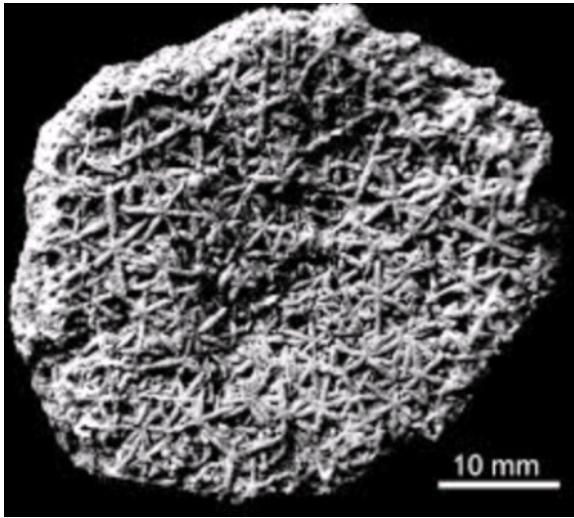


Hydnoceras

21. (1.00 pts) The mineralized skeleton of Specimen G is composed of

- A) calcium carbonate
- B) calcium phosphate
- C) silicate
- D) chitin

22. (1.00 pts) Identify the genus represented by Specimen H.



Astraeospongia

23. (1.00 pts) The mineralized skeleton of Specimen H is composed of

- A) calcium carbonate
- B) calcium phosphate
- C) silicate

D) chitin

24. (1.00 pts) How many layers of tissue are found in Specimen H?

0

25. (1.00 pts) Identify the genus represented by Specimen I.



Septastrea

26. (1.00 pts) Provide a temporal range (in geologic periods) for the **order** represented by Specimen I.

period to period (do not include descriptors like 'upper', 'middle', etc.)

Triassic

Quaternary

27. (1.00 pts) Identify the genus represented by Specimen J.



Halysites

28. (1.00 pts) Provide a temporal range (in geologic periods) for the **order** represented by Specimen J.

period to period (do not include descriptors like 'upper', 'middle', etc.)

Ordovician

Permian

29. (1.00 pts) Identify the genus represented by Specimen K.



Heliophyllum

30. (1.00 pts) Provide a temporal range (in geologic periods) for the **order** represented by Specimen K.

_____ period to _____ period (do not include descriptors like 'upper', 'middle', etc.)

Ordovician

Permian

31. (1.00 pts) Specimen J is best described as

- A) solitary
- B) colonial

32. (1.00 pts) Specimen K is best described as

- A) solitary
- B) colonial

33. (1.00 pts) Which specimen is most closely related to living corals?

- A) Specimen G
- B) Specimen H
- C) Specimen I
- D) Specimen J
- E) Specimen K

34. (2.00 pts) Besides corals, name **two** other groups of organisms that form reefs or have been known to do so in the past

Expected Answer: any TWO of the following: calcareous algae, sponges, bivalves, echinoderms, stromatolites, stromatoporoids, bryozoans, brachiopods, archaeocyathids

35. (1.00 pts) Identify the genus represented by Specimen L.



Dunkleosteus

36. (2.00 pts) Why do we know so little about the tail end of Specimen L?

(Mark **ALL** correct answers)

- A) the genus is known only from one incomplete fossil
- B) the tail end was likely made of cartilage, which does not fossilize easily
- C) only the head and frontal sections were covered in armor
- D) the tail end was composed of smaller bones that get disarticulated easily
- E) trick question—we do have a good idea what the tail end looked like!

37. (1.00 pts) Identify the genus represented by Specimen M.



Bothriolepis

38. (1.00 pts) What kinds of environments would Specimen M have been able to tolerate?

- A) freshwater, only
- B) saltwater, only
- C) both freshwater and saltwater
- D) terrestrial

39. (1.00 pts) Identify the genus represented by Specimen N.



Otodus

40. (1.00 pts) Identify the genus represented by Specimen O.



Carcharocles

41. (2.00 pts) Give **two** reasons why teeth are the most common kind of shark fossil found (compared to body fossils).

Expected Answer: skeleton is made of cartilage (1) AND sharks lose and replace teeth (1)

42. (1.00 pts) Identify the genus represented by Specimen P.



acanthostega

43. (1.00 pts) Identify the genus represented by Specimen Q.



Tiktaalik

44. (1.00 pts) Identify the genus represented by Specimen R.



Eusthenopteron

45. (1.00 pts) Order Specimens P, Q, and R in terms of appearance in the fossil record.

oldest → youngest

- A) $P \rightarrow Q \rightarrow R$
- B) $P \rightarrow R \rightarrow Q$
- C) $Q \rightarrow P \rightarrow R$
- D) $Q \rightarrow R \rightarrow P$
- E) $R \rightarrow P \rightarrow Q$
- F) $R \rightarrow Q \rightarrow P$

46. (1.00 pts) What kind(s) of respiratory organs did Specimen Q most likely possess?

- A) lungs, only
- B) gills, only
- C) both lungs and gills
- D) neither lungs nor gills—gas exchange occurred across the skin

47. (1.00 pts) Identify the order represented by Specimen S.



Naufragida

48. (1.00 pts) The wire curling along the spiral of the specimen you identified in the previous question is located where the _____ would be.

siphuncle

49. (1.00 pts) Identify the order represented by Specimen T.



Ceratitida

50. (1.00 pts) Identify the order represented by Specimen U.



Goniatitida

51. (1.00 pts) Identify the order represented by Specimen V.



Ammonitida

52. (1.00 pts) What is meant by the term **heteromorph** as it applies to Specimens S-V?

(Mark ALL correct answers)

- A) having an appearance vastly different from closely related taxa
- B) not being tightly coiled or being irregularly coiled
- C) having multiple intraspecific shell forms
- D) occurring in different localities than than the type specimen
- E) different stages of the life cycle that were thought to be entirely different species

53. (3.00 pts) What are true statements regarding the differences/similarities between Specimen S and Specimen V?

(Mark ALL correct answers)

- A) Specimen V has more complex septa
- B) The wire from Q48 on Specimen V is also located medially

- C) Specimen S are still alive today
- D) Specimen S lived shorter lifespans compared to Specimen V
- E) Specimen V died out during the K-T Extinction
- F) Both are divided into chambers that help with buoyancy

54. (1.00 pts) Identify the genus represented by Specimen X.



Exogyra

55. (1.00 pts) Identify the genus represented by Specimen Y.



Cypraea

56. (1.00 pts) Identify the genus represented by Specimen Z.



Turritella

57. (1.00 pts) Identify the genus represented by Specimen AA



Conus

58. (1.00 pts) Specimen AA is best described as _____, and most species are _____.

- A) sinistral, sinistral
- B) sinistral, dextral
- C) dextral, sinistral
- D) dextral, dextral

59. (1.00 pts) Are Specimens X, Y, Z, and AA all in the same class? If yes, name the class. If not, identify the letter of the odd one out.

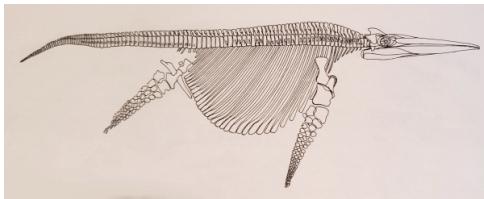
X

60. (2.00 pts) What is responsible for creating the hole in the specimen below? be specific!



Expected Answer: predation from a CRAB/CRUSTACEAN

61. (1.00 pts) Identify the order represented by Specimen BB.



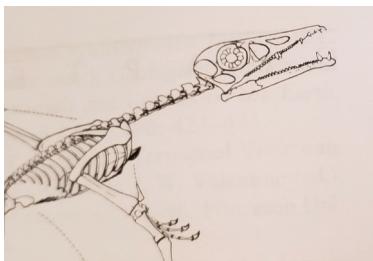
Ichthyosauria

62. (1.00 pts) Identify the order represented by Specimen CC.



Squamata

63. (1.00 pts) Identify the order represented by Specimen DD.



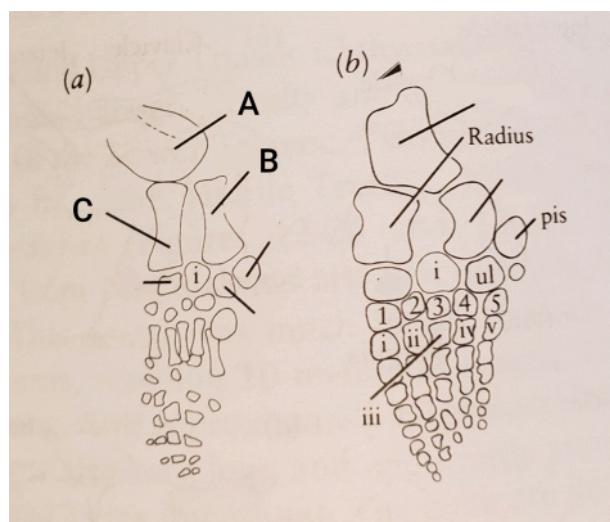
Pterosauria

64. (1.00 pts) Identify the order represented by Specimen EE



Plesiosauria

Refer to the diagram below to answer Q65-Q69.



65. (1.00 pts)

Referring to the partially labeled example on the left labeled (b), you can conclude (based on your knowledge on anatomy) the names of the bones that compose this limb. What is the bone labeled A?

humerus

66. (1.00 pts)

Referring to the partially labeled example on the left labeled (b), you can conclude (based on your knowledge on anatomy) the names of the bones that compose this limb. What is the bone labeled B?

ulna

67. (1.00 pts)

Referring to the partially labeled example on the left labeled (b), you can conclude (based on your knowledge on anatomy) the names of the bones that compose this limb. What is the bone labeled C?

radius

68. (1.00 pts) Which specimen does this diagram represent?

- A) BB
- B) CC
- C) DD
- D) EE
- E) None of the above

69. (2.00 pts) Which of the following are true regarding the order represented by Specimen EE?

(Mark ALL correct answers)

- A) They died out during the K-T Extinction
- B) It has a synapsid
- C) Its most likely ancestor is the nothosaurs
- D) There are approximately 190 genera in this order
- E) It moved through the water primarily with its tail
- F) The order consists of two main morphological types, based on the size of the head and the length of the neck

70. (1.00 pts) The order represented by Specimen EE has historically been a wastebasket taxon. What does this mean?

- A) Its classification is unofficial
- B) The requirements of which they are classified keep changing
- C) Its purpose is to classify those that do not fit in other classifications
- D) It includes a broader range of organisms
- E) None of the above

71. (1.00 pts) What type of skull does Specimen BB have?

- A) Anapsid

- B) Synapsid
- C) Diapsid
- D) Euryapsid
- E) It does not have a skull

72. (2.00 pts) What time periods did Specimen DD exist?

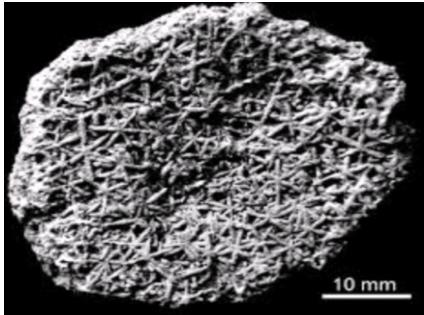
(Mark ALL correct answers)

- A) Permian
- B) Triassic
- C) Jurassic
- D) Cretaceous
- E) Paleogene
- F) Neogene

73. (1.00 pts) Which digit in Specimen DD extended into the wings?

- A) 1
- B) 2
- C) 3
- D) 4
- E) 5
- F) None of the above

74. (1.00 pts) Identify the Order represented by Specimen FF. (HINT: this is an eye)

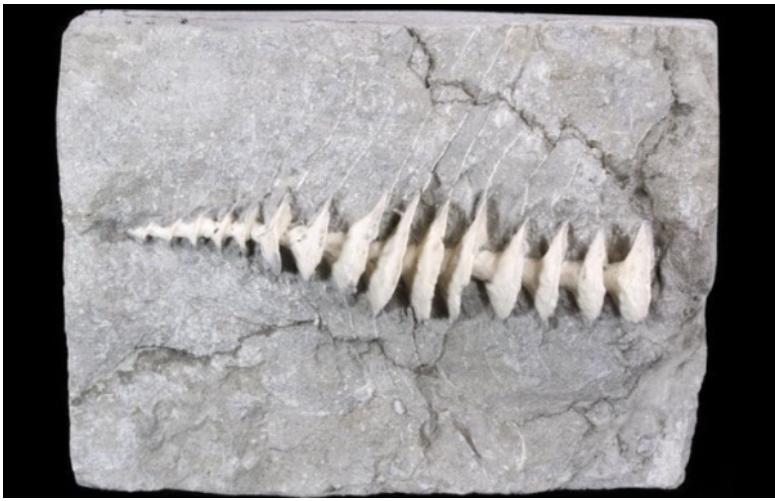


Ichthyosuria

75. (1.00 pts) What is the ring in the eye from the previous question called?

sclerotic ring

76. (1.00 pts) Identify the genus represented by Specimen GG.



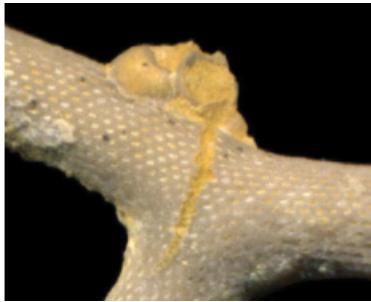
Archimedes

77. (1.00 pts) What **growth form** is represented by Specimen GG?

(Mark **ALL** correct answers)

- A) branching
- B) massive
- C) fenestrate
- D) None of the above

78. (1.00 pts) Identify the genus represented by Specimen HH.



Rhombopora

79. (1.00 pts) A living individual of Specimen HH is called a(n)

- A) zooecium
- B) zooarium
- C) zooid

80. (1.00 pts) The skeleton of an individual of Specimen HH is called a(n)

- A) zooecium

- B) zooarium
- C) zooid

81. (1.00 pts) The skeleton of a colony of Specimen HH is called a(n)

- A) zooecium
- B) zooarium
- C) zooid

82. (1.00 pts) Identify the genus represented by Specimen JJ.



Mucrospirifer

83. (1.00 pts) Identify the genus represented by Specimen KK.



Pecten

84. (1.00 pts) Identify the genus represented by Specimen LL.



Rafinesquina

85. (1.00 pts) Identify the genus represented by Specimen MM.



Astarte

86. (1.00 pts) Identify the genus represented by Specimen NN.



Gryphaea

87. (2.00 pts) Which specimens at this station are **brachiopods**?

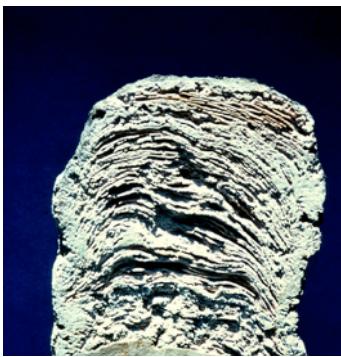
(Mark ALL correct answers)

- A) Specimen JJ
- B) Specimen KK
- C) Specimen LL
- D) Specimen MM
- E) Specimen NN

88. (1.00 pts) Between brachiopods and bivalves, which group has higher metabolism?

- A) brachiopods
- B) bivalves

89. (1.00 pts) What is the structure depicted in Specimen OO called?



stromatolite

90. (1.00 pts) What kind of organisms form the structure you identified in the previous question?

- A) fungi
- B) terrestrial vertebrates
- C) foraminifera
- D) cyanobacteria
- E) bryozoans
- F) the structure is not biological in origin

91. (1.00 pts)

These structures are relatively abundant in very old rock layers, but are much less common in layers from the last 500 million years. What might account for this trend?

- A) animal grazing prevents them from forming in great abundance
- B) these structures only form in anoxic (low-oxygen) environments
- C) erosion and tectonic activity had much less of a presence back then
- D) the organisms that formed these structures went extinct around 500 million years ago
- E) these structures only form during Snowball Earth conditions

92. (1.00 pts) Identify the order represented by Specimen PP.



Rotaliida

93. (1.00 pts) Which of the following best describes the life habit of Specimen PP?

- A) benthic
- B) pelagic and planktonic
- C) pelagic and nektonic

94. (1.00 pts) Identify the order represented by Specimen QQ.



Fusulinida

95. (1.00 pts) Which of the following best describes the life habit of Specimen QQ?

- A) benthic
- B) pelagic and planktonic
- C) pelagic and nektonic

96. (1.00 pts) What are the functions of **pseudopodia** in Specimen PP?

(Mark **ALL** correct answers)

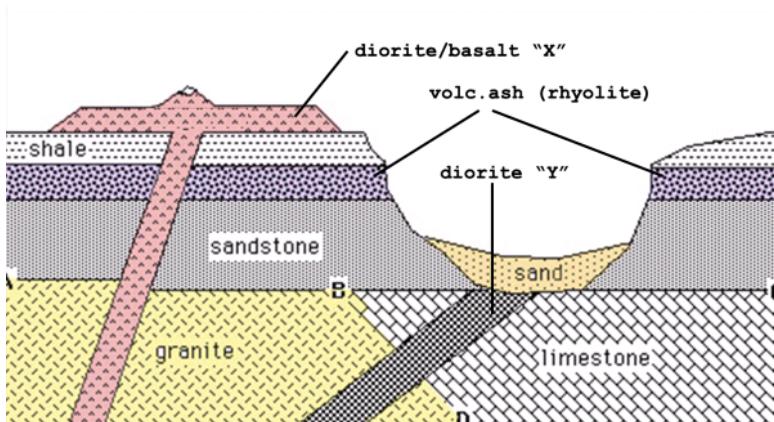
- A) feeding
- B) reproduction
- C) locomotion
- D) defense

97. (1.00 pts) Specimen QQ is an excellent index fossil. What are some of the characteristics of a good index fossil?

(Mark **ALL** correct answers)

- A) narrow temporal range
- B) narrow geographical range
- C) wide temporal range
- D) wide geographical range
- E) easily identifiable
- F) preserved hard parts

98. (1.00 pts) Which rock in the stratigraphic diagram below is **oldest**?



- A) diorite/basalt "X"
- B) diorite "Y"
- C) granite
- D) limestone
- E) sandstone
- F) shale

99. (1.00 pts) Which rock in the stratigraphic diagram above is **youngest**?

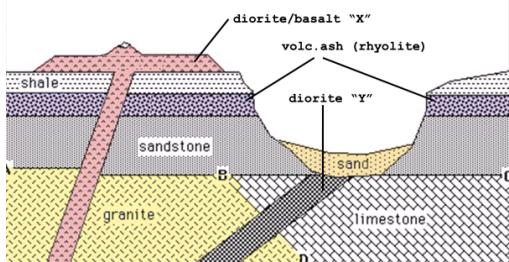
- A) diorite/basalt "X"
- B) diorite "Y"
- C) granite
- D) limestone
- E) sandstone
- F) shale

100. (1.00 pts) Which of Steno's 4 principles did you use to answer questions 99 and 100?

(Mark **ALL** correct answers)

- A) superposition
- B) original horizontality
- C) lateral continuity
- D) cross-cutting

101. (2.00 pts) Which rock(s) in the stratigraphic diagram below are **sedimentary**?



(Mark **ALL** correct answers)

- A) diorite/basalt "X"
- B) diorite/basalt "Y"
- C) granite
- D) limestone
- E) sandstone
- F) shale

102. (1.00 pts)

Suppose the volcanic ash (rhyolite) layer in the stratigraphic diagram above was determined to be 12 million years old, and the limestone layer contains a gastropod fossil that is found in strata that are between 17 and 9 million years old. What can you say about the age of the sandstone layer?

- A) younger than 9 million years
- B) younger than 12 million years
- C) between 9 and 12 million years old
- D) between 9 and 17 million years old
- E) between 12 and 17 million years old
- F) older than 17 million years

103. (2.00 pts)

Carbon-14 has a half-life of 5,730 years. Suppose you find a shell that has 6.25% of its initial amount of C-14. How old can you say the shell is? Provide your answer with four significant figures.

22920

104. (1.00 pts) Fossils are only found in sedimentary rocks, never igneous or metamorphic.

- True
- False

105. (1.00 pts) Identify the genus represented by Specimen RR.



Iguanodon

106. (1.00 pts) Identify the genus represented by Specimen SS.



Parasaurolophus

107. (1.00 pts) Identify the genus represented by Specimen TT.



Velociraptor

108. (1.00 pts) Identify the genus represented by Specimen UU.



Stegosaurus

109. (1.00 pts) Which specimen was the first to be officially described?

- A) Specimen RR
- B) Specimen SS
- C) Specimen TT
- D) Specimen UU

110. (3.00 pts) Name the three bones that make up the hip in all four of the above specimens.

Expected Answer: in any order: ilium, ischium, pubis

111. (1.00 pts) Objects like this one below are often found in tandem with certain dinosaur fossils.

What are these objects called?



Expected Answer: gastrolith (accept stomach stone or gizzard stone)

112. (1.00 pts) What was the function of the structure you identified in the previous question?

Expected Answer: accept any answer that mentions digestion

113. (1.00 pts) When did the last dinosaurs go extinct?

Expected Answer: accept any answer that mentions that dinosaurs are NOT extinct

114. (1.00 pts) Specimen WW (below) is a very famous fossil known as the London Specimen.

Identify the genus represented by Specimen WW.



Archaeopteryx

115. (1.00 pts) The most complete existing specimen of the genus you identified above (and also the most iconic) is better known as the _____ specimen.

Berlin

116. (1.00 pts) In total, how many **body fossil** specimens of the genus you identified above have been discovered?

12

117. (1.00 pts) Specimens in this genus are most closely associated with which lagerstätten?

- A) Mazon Creek
- B) Ghost Ranch
- C) Solnhofen Limestone

- D) Yixian Formation
- E) Green River Formation
- F) Burgess Shale

118. (1.00 pts) What kind of lagerstätten is the one you identified in the previous question?

- A) a concentration lagerstätten
- B) a conservation lagerstätten

119. (2.00 pts) Specimen WW is part of a broader trend in our understanding of the origin of birds.

Which of the following characteristics of Specimen WW are **not** present in modern birds? (choose all that apply)

(Mark **ALL** correct answers)

- A) claws
- B) feathers
- C) wings
- D) teeth
- E) long tail

120. (2.00 pts)

We now know that feathers were present on many groups that weren't capable of powered flight or even gliding. Name two alternative functions of feathers (besides flight or gliding) that may explain this pattern.

Expected Answer: insulation/keeping warm (1) AND display/mating/sexual selection (1)

121. (1.00 pts) Preserved feathers are perhaps best known from which lagerstätten (excluding the one you identified in Q114)?

- A) Mazon Creek
- B) Ghost Ranch
- C) Solnhofen Limestone
- D) Yixian Formation
- E) Green River Formation
- F) Burgess Shale

122. (1.00 pts) Identify the class represented by Specimen XX.



Blastoidea

123. (1.00 pts) Identify the class represented by Specimen YY.



Astroidea

124. (1.00 pts) Identify the class represented by Specimen ZZ.



Echinoidea

125. (1.00 pts) Specimen ZZ is best described as

- A) irregular

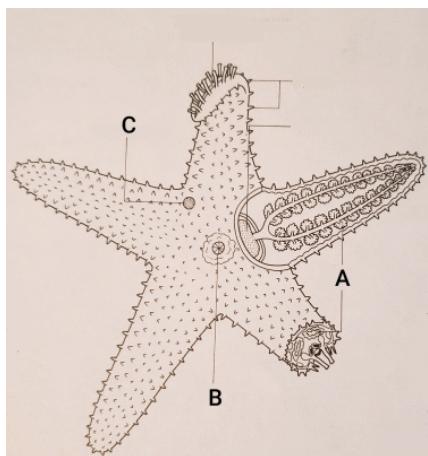
- B) semiregular
- C) regular
- D) none of the above can be used to describe this specimen

126. (1.00 pts) Identify the class represented by Specimen AAA.



Crinoidea

Refer to the diagram below to answer Q127-131.



127. (1.00 pts) Identify the class represented by the diagram.

Astroidea

128. (1.00 pts) What kind of glands does A point to?

digestive

129. (1.00 pts) What anatomical part does B point to?

anus

130. (2.00 pts) C points to a feature specific to this phylum. Name this feature.

madreporite

131. (3.00 pts) Check all the following statements that are true about the structure you identified in the previous question.

(Mark ALL correct answers)

- A) It is a perforated plate
- B) It is a part of the digestive system
- C) It is mostly composed of calcium carbonate
- D) It filters water into the specimen
- E) It is a single opening
- F) It is a type of gland

132. (1.00 pts) All the specimens in this station fall under the same phylum. What is this phylum?

- A) Cnidaria
- B) Hemichordata
- C) Mollusca
- D) Brachiopoda
- E) Echinodermata
- F) none of the above

133. (2.00 pts) Which of the following are true regarding this phylum?

(Mark ALL correct answers)

- A) Adults have radial symmetry
- B) This phylum first arose during the Silurian period
- C) An embryo is bilaterally symmetrical
- D) Asteroidea is the most diverse class
- E) All classes under this phylum are protosomes

134. (2.00 pts) What are two types of cups that can be found in the same class as Specimen AAA?

Expected Answer: monocyclic (1) & dicyclic (1)

135. (1.00 pts) Reproduction among creatures in the same class as Specimen AAA are usually asexual.

- True
- False

136. (1.00 pts) What body part on Specimen AAA is used as legs for locomotion?

cirri

137. (1.00 pts) Specimen AAA is the state fossil of what state? (Type out full name of state; no abbreviations)

Missouri